**TO:** USAID

**FROM:** Leo Do, Teacher Extraordinaire

**SUBJECT: Addressing Returns to Education in 5 Countries in Africa**

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Education theory generally states that with more years of schooling, people will get higher returns in wages. Meaning people will be more inclined to pursue higher education to join the skilled labor forces. Industries and subsequently the labor forces should be seen achieving and having higher degrees within their employees. In this study, data was randomly compiled from five African countries in the 1990s and their firms specifically from Ghana, Zambia, Zimbabwe, Cameroon, and Kenya. Figure 1 suggests this visual with the correlation of value added per employee[[1]](#footnote-1) increasing as firms increase their total years of education[[2]](#footnote-2). Value added will be defined as the value of sales less material input costs less indirect costs[[3]](#footnote-3) and will be logarithmically transformed to have easier comparability between the firms. When calculating the average proportion of a firm that has attained a university degree signaling the hypothesis that skilled labor stemming gives higher value, what was discovered was that the average proportion of a firm was only 5.584767. The study will focus on the rates of returns on human capital and seeing if it is significant in its effects. The dependent variable will be the value added and the independent variable of focus is education. The study finds a significant finding for education to a degree of 1.016% increases in value added per employee if education was increased by 1%.

**Progression of the Model and Problem Solving**:

The variables were logarithmically transformed to allow a log-log interpretation. After this transformation the model[[4]](#footnote-4) initially starts with a simple bivariate comparison of education years and value added then into other possible omitted variables could be biasing the equation such as a person’s ability illustrated through their tenure[[5]](#footnote-5) to see if that is explaining why there is a low average education year amount at play. Later the model considers keeping the specific countries as part of the controls to see if there is any discrepancy within the individual countries and the manufacturing sector themselves could be biasing the returns of education levels for firms. The model then tests the interaction between the countries and education to see if both together has an additional effect intrinsic to that countries education system. With the models including any form of the countries, the baseline comparison to be compared to will be the country of Cameroon to avoid perfect collinearity. To test against the heteroscedastic found and suspected from both the Breusch-Pagan/Cook-Weisberg and white’s test, robust regressions was utilized. With this model only 3 egregious outlier firms were found within Ghana, Cameroon, and Zambia respectively.

**Findings:**

First, to legitimize the model’s ability to be B.L.U.E.[[6]](#footnote-6) was taken into consideration during the evolution of the model through collinearity VIF values lower than 10, robust regressions, linear model creation, random sampling of the data, and attempts to ensure zero conditional mean. Additionally the goodness of fit is to be trusted due to the root MSE value of 1.24 showing that the errors are centered near the best fit line. The results are indicating consistently significant to the 99.9% degree of confidence that a 1% increase in education within a firm results in an increase in firm productivity with additional effects stemming from the Kenyan education system but consistent insignificance from all other countries interaction with education levels and the interaction of education and tenure. This insignificance between education and tenure-based ability may be indicating a one or the other situation hence the significance of both individually indicating results in value added to a 99.9% significance level. The bias possibility the manufacturing sectors have atypical workers are deemed significant only within the metal sector in the final model to a 95% degree of confidence. As the model grew, the result is essentially the same interpretation compared to the bivariate case at the start where with a 1% increase in education there will be a resulting 1.016% increase in value added per employee with a counter argument of working allowing for significant returns that only was proven to be overstating the results as the model progressed. The additional effects in figure 3 that Kenya exhibits is seen visually to be higher than Cameroon.

**Limitations:**

With this model possible limitations would be the inefficiency of the coefficients predicted to be consistent in illustrating the value added dependent variable all stemming from the heteroscedasticity seen in the model that would dilute the root MSE credibility. The results before and after the robust testing do not change the significance ratings of the variables at hand and methods to fix the problem could have been implemented. Endogeneity problems may be stemming from the unclear nature of how value added was to be calculated resulting in possible regression dilution[[7]](#footnote-7), stochastic, or systematic errors moving the regression’s estimate away from the true fit line.

**Conclusion:**

The returns from working rather than pursuing education are significant illustrating a possible idea in which people within these countries could be analyzing their situation as opportunity cost of forgone wages. We find significant results within both education and tenure substantializing this possible situation. Therefore, we would recommend pursuing policy levers in which education is promoted and raised in its intrinsic value for individual people so that people can pursue that rather than work starting young. The policy levers would be recommended within Kenya and Cameroon since they are seen to have a significant relationship with returns to education with focus on Kenya.



Figure 2

Figure 1



Figure 3



Table 1: Dependent Variable: Log of Value Added per Employee in US PPP

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| VARIABLES | Log of value-added in US$ PPP | Log of value-added in US$ PPP | Log of value-added in US$ PPP | Log of value-added in US$ PPP | Log of value-added in US$ PPP | Log of value-added in US$ PPP |
|  |  |  |  |  |  |  |
| Log of total years of education in firm | 1.229\*\*\* | 0.695\*\*\* | 0.634\*\*\* | 0.802\*\*\* | 0.790\*\*\* | 1.016\*\*\* |
|  | (0.0344) | (0.103) | (0.118) | (0.108) | (0.107) | (0.167) |
| Log of total tenure of workers in firm |  | 0.465\*\*\* | 0.411\*\*\* | 0.293\*\*\* | 0.291\*\*\* | 0.333\*\*\* |
|  |  | (0.0809) | (0.111) | (0.100) | (0.0999) | (0.116) |
| Interaction between Education and Tenure (Logged) |  |  | 0.0103 | 0.00347 | 0.00471 | -0.00566 |
|  |  |  | (0.0129) | (0.0122) | (0.0118) | (0.0164) |
| Ghana\*Log Total Education |  |  |  |  |  | -0.168 |
|  |  |  |  |  |  | (0.121) |
| Kenya\*Log Total Education |  |  |  |  |  | -0.246\*\* |
|  |  |  |  |  |  | (0.107) |
| Zimbabwe\*Log Total Education |  |  |  |  |  | -0.0914 |
|  |  |  |  |  |  | (0.106) |
| Zambia \* Log Total Education |  |  |  |  |  | -0.181 |
|  |  |  |  |  |  | (0.172) |
| Wood or Furniture Sector |  |  |  |  | -0.226\* | -0.195 |
|  |  |  |  |  | (0.128) | (0.130) |
| Textile or Clothing sector |  |  |  |  | -0.273\* | -0.252 |
|  |  |  |  |  | (0.163) | (0.170) |
| Metal Sector |  |  |  |  | 0.261\*\* | 0.281\*\* |
|  |  |  |  |  | (0.112) | (0.114) |
| Constant | 5.172\*\*\* | 5.797\*\*\* | 6.075\*\*\* | 6.584\*\*\* | 6.600\*\*\* | 5.406\*\*\* |
|  | (0.204) | (0.232) | (0.399) | (0.388) | (0.384) | (0.792) |
|  |  |  |  |  |  |  |
| Observations | 709 | 705 | 705 | 705 | 705 | 705 |
| R-squared | 0.707 | 0.725 | 0.726 | 0.775 | 0.780 | 0.783 |

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Returns to education are deemed to be highly significant in the simple model and to a similar degree at the final progression of the model. The additional effects that Kenyan has when interacted lowers the effects of education in comparison to Cameroon hence aid should be focused on them to improve education and skilled labor within the metal manufacturing sector.

1. In terms of $US Purchasing Power Parity [↑](#footnote-ref-1)
2. Logarithmically transformed to allow a percentage increasement analysis of value added dependent on a one percent increase of Education [↑](#footnote-ref-2)
3. Bigsten, A., Isaksson, A., Söderbom, M., Collier, P., Zeufack, A., Dercon, S., . . . Pattillo, C. (2000). Rates of Return on Physical and Human Capital in Africa's Manufacturing Sector. Economic Development and Cultural Change, 48(4), 801-827. [↑](#footnote-ref-3)
4. Table 1 will be interpreted as the term the model [↑](#footnote-ref-4)
5. Total years tenured logarithmically transformed [↑](#footnote-ref-5)
6. Best Linear Unbiased Estimator [↑](#footnote-ref-6)
7. Attenuation towards zero [↑](#footnote-ref-7)